

TAXONOMY OF THE *CASTILLEJA TENUIFLORA* GROUP
(SCROPHULARIACEAE) IN MEXICO, WITH AN OVERVIEW
OF SECT. *CASTILLEJA*

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ABSTRACT

Castilleja tenuiflora, *C. auriculata*, and *C. integrifolia* (sect. *Castilleja*) are closely related species widely distributed in México. *Castilleja integrifolia* is broadly sympatric with the other two, which have separate though significantly overlapping geographic distributions. One new species is recognized from within the *C. tenuiflora* group, *C. tancitaroana*, which occurs from Nayarit to Veracruz and Oaxaca. Two varieties are recognized in *C. tenuiflora*, including the yellow bracted var. *xylorrhiza* comb. et stat. nov. from northeastern México. Two varieties are recognized within *C. auriculata*: var. *auriculata* and var. *verecunda* var. nov. Three other Mexican species more peripherally related to *C. tenuiflora* are described: *C. stipifolia*, from Jalisco to Edo. México and Guerrero; *C. filiflora*, from east central Chiapas; and *C. perelegans*, endemic to southern Durango. One new combination is proposed: *Castilleja subinclusa* var. *franciscana* comb. et stat. nov. A key is provided for identification of the eighteen Mexican and Guatemalan species of sect. *Castilleja* and seven other species with an irregularly cleft calyx.

KEY WORDS: *Castilleja*, Scrophulariaceae, México

The species of *Castilleja* sect. *Castilleja* (sect. *Hemichroma* Benth., sensu Eastwood 1909; sect. *Linariifolia* Pennell, Pennell 1951) include the South American generitype, *C. fissifolia* L. f., and are primarily characterized by calyces with a deeply cut (anterior) abaxial cleft and shallow (posterior) adaxial one, the lateral clefts absent or relatively shallow notches. Other characteristic but more variable features of the group are a racemose inflorescence, colored calyces but green floral bracts, and the galea as long or longer than the corolla

tube (Holmgren 1976, 1978). There are two other species groups that produce irregularly divided calyces: those with annual duration (one perennial species), pectinately divided leaves, and a relatively short galea are placed in sect. *Epichroma* Benth.; two species transitional between sect. *Castilleja* and sect. *Epichroma* are without a formal taxonomic designation but referred to by Holmgren (1976) as "the Ortegae group" (see key below). A hypothesis of close evolutionary relationship among these three groups must be regarded as speculative, but based on their calyx morphology, they are distinct from the rest of the genus. All three are a part of subg. *Castilleja* (sensu Chuang & Heckard 1991).

About twenty-six species are now recognized within sect. *Castilleja*, eighteen from México, six others endemic to Central America (Holmgren 1978). *Castilleja fissifolia* is endemic to South America. Five species occur in the United States: *Castilleja linariifolia* Benth., *C. patriotica* Fern., and *C. tenuiflora* Benth. occur both in northwestern México and in the southwestern United States; *C. wootonii* Standley is closely related to *C. linariifolia* but is isolated in southeastern New Mexico and adjacent Texas (Nesom 1992a); *C. franciscana* Penn., *C. subinclusa* E. Greene, and *C. jepsonii* Bacig. & Heck. are primarily endemic to California, the latter also occurring in Baja California (see Holmgren 1976). The last three species have been regarded as closely related among themselves (Bacigalupi and Heckard 1966), and Chuang and Heckard (1992) have treated them as a single species. The Ortegae group (two species) and all species of sect. *Epichroma* (six) are restricted to México, except for *C. tayloriorum* N. Holmgren, which is endemic to Costa Rica.

Three common Mexican species of sect. *Castilleja*, *C. tenuiflora*, *C. auriculata* Eastw., and *C. integrifolia* L. f., have often been confused in identification. Holmgren's treatment (1976) reviewed the taxonomy of the *C. tenuiflora* group but dealt with only part of the complexity among the more widespread taxa. The present study concentrates on these and completes my taxonomic study of *Castilleja* in northeastern México (Nesom 1992b). While additional Mexican species of sect. *Castilleja* may yet be discovered, these will almost certainly be narrow endemics, and the study presented here will provide further background for their interpretation.

I. Variation in *Castilleja tenuiflora* Benth.

Castilleja tenuiflora Benth., *Pl. Hartweg.* 22. 1839. TYPE: MEXICO.

Bentham cited neither a locality nor a specific Hartweg collection. The sequential listing in *Plantae Hartwegianae* is "191;" Holmgren (1976) cited "*Hartweg 191*" from Aguascalientes in 1837 as the type.

Castilleja tenuiflora var. *tenuiflora*

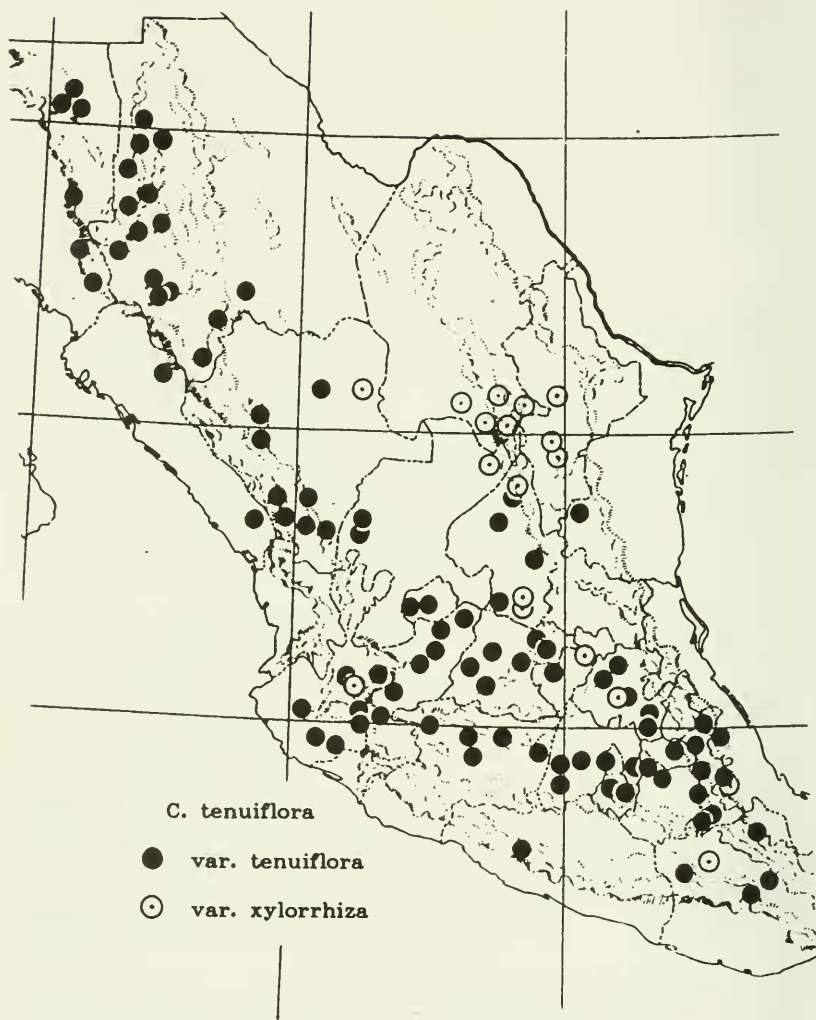
Castilleja longiflora Kunze, *Linnaea* 16:312. 1842. TYPE: MEXICO. Locality unspecified, but apparently grown from seeds collected by Ehrenberg in a "cold region" of México. I have not seen type material, but the original publication clearly describes a plant similar to *C. tenuiflora*. Eastwood (1909) maintained *C. longiflora* as a separate species closely related to *C. auriculata* (see further comments below), identifying the two as a pair in her key on the basis of glandular vestiture, but she did not indicate that she studied the type of *C. longiflora*. There is no reference at all in Kunze's original description to vestiture, one of the most distinctive features of *C. auriculata*, and without the specimen, there is no reason to assume that it is glandular. Bentham (in DC., *Prodr.* 10:533. 1846.), who noted that he studied the Ehrenberg specimen, described the vestiture of *C. longiflora* as canescent-hispid, without any mention of glandularity; he further observed that *C. longiflora* is scarcely different from *C. canescens*, and compared *C. tenuiflora* with both *C. canescens* and *C. longiflora*, noting as differences among the features accepted here as within the bounds of *C. tenuiflora*.

Castilleja canescens Benth. in DC., *Prodr.* 10:533. 1846. LECTOTYPE (designated here): MEXICO. Edo. México: circa Toluca, April 1832, *Andrieux 156* (G-DC fiche!). This is a full specimen, a single plant, clearly identified and annotated. Bentham also cited *Berlandier 660* and *1213* and *Galeotti 992* and *1087*.

Castilleja laza A. Gray in Emory, *Rep. U.S. & Mex. Bound. Survey* 2(1):119. 1858. TYPE: MEXICO. Sonora: mountain sides near Santa Cruz, 1851, *C. Wright 1490* (HOLOTYPE: GH!; Isotypes: GH-2 sheets!). See Boufford & Nesom (in prep.) for comments.

Castilleja scabridula Eastw., *Proc. Amer. Acad. Arts* 44:586. 1909. TYPE: MEXICO. Durango: Tejaman, Aug 1906, *E. Palmer 468* (HOLOTYPE: GH!; Isotype: MO!).

Sonora, Chihuahua, Sinaloa, Durango, Zacatecas, San Luis Potosí, Tamaulipas, Jalisco, Aguascalientes, Guanajuato, Hidalgo, Puebla, Veracruz, Tlaxcala, Michoacán, México, Distrito Federal, Morelos, Guerrero, Oaxaca (Map 1); matorral to oak, pinyon-juniper, oak, pine, and fir woods, roadside banks, rocky slopes, (1350-)1700-3000(-3900) m; all year but apparently less commonly April-June.



Map 1. Distribution of *Castilleja tenuiflora* (var. *tenuiflora* and var. *xylorrhiza*). Var. *tenuiflora* also occurs in southern Arizona. Yellow bracted plants south of San Luis Potosí are best regarded as populational variants of var. *tenuiflora* (see text for comments).

Holmgren (1976) provided taxonomic details regarding two other taxa that he considered to be synonyms of *Castilleja tenuiflora*: *C. retrorsa* Standley and *C. setosa* Pennell, both from southeastern Arizona. Such plants from this area need to be evaluated in more detail, as at least some of them appear to be significantly different from *C. tenuiflora* in aspects of their vestiture.

Distinctions among most of the taxa that Eastwood recognized as closely related to *Castilleja tenuiflora* are accepted here as aspects of variation within a single species. In northern Durango, Chihuahua, and Sonora many plants (including the type specimens of *C. laza* and *C. scabridula*) characteristically produce flowers on pedicels 2-4 mm long and leaf bases with a tendency to be basally attenuate and nonauriculate, at least on the upper portion of the stem, and the plants perhaps are shorter in duration. In the same area, however, are more typical plants and apparently intergrading forms; field work will be valuable in further interpretation of the variation.

Plants of *Castilleja tenuiflora* with spreading-ascending (vs. descending) stem hairs occur sporadically throughout the range of the species, and they are not regarded as taxonomically significant. Plants with glandular vestiture, often identified as *C. tenuiflora*, are treated here as *C. auriculata* Eastw. and *C. tancitaroana* Nesom (see below). Holmgren (1976) apparently included both within his concept of *C. tenuiflora*, although he did not mention variability in vestiture.

Castilleja tenuiflora Benth. var. *xyloirrhiza* (Eastw.) Nesom, *comb. et stat. nov.* BASIONYM: *Castilleja xyloirrhiza* Eastw., Proc. Amer. Acad. Arts 44:586. 1909. TYPE: MEXICO. Coahuila: Sierra Encarnaciore, 28 Jul 1896, E.W. Nelson 3895 (HOLOTYPE: GH!).

Durango, Coahuila, Nuevo León, Zacatecas, San Luis Potosí, and as yellow variants within var. *tenuiflora*, Querétaro, Hidalgo, Veracruz, and Oaxaca (Map 1); chaparral to pinyon pine, oak, oak-juniper, or pine-oak woodlands, limestone and gypsum, 1200-2550 m; (May-)June-November.

Plants of var. *xyloirrhiza* produce yellow bracts and calyces, without any red coloration, and although the difference is striking and easily discernible, they appear to be similar in all other respects to those of typical *Castilleja tenuiflora*. In Nuevo León and Coahuila, var. *xyloirrhiza* essentially replaces the typical, red bracted plants, which have a much wider geographic range (Map 1). Both "red" and "yellow" forms apparently occur within the same population in areas where the geographic ranges of the two varieties meet, primarily in southeastern Coahuila and adjacent areas of northern Zacatecas and San Luis Potosí. For example, in the Sierra de Catorce (W of Matehuala, San Luis Potosí, 24 July 1934, GH) Pennell collected both red (17517) and yellow (17525) forms; in San Lorenzo Canyon (S of Saltillo, Coahuila, 22 July 1934, GH), he collected both color forms and intermediates (17499-red, 17501-

yellow, 17503-orange). Numerous other collections (TEX) have been made from San Lorenzo Canyon and show the same pattern of variation.

Yellow bracted plants of *Castilleja tenuiflora* occur mostly along the eastern periphery of the range of the species in areas where the typical variety is more common: MEXICO. San Luis Potosí: Sierra de Alvarez, Pennell 17748 (GH,MICH) and 17800 (GH,MICH) and La Salitrera, 20 km W of Zaragoza, Rzedowski 6132 (MICH); Hidalgo: Dist. Actopan, Cerro de las Canteras, Moore 1484 (GH) and near Yolotepec, Lundell 12536 (LL,MICH); Querétaro: between Jalpan and Cadereyta on Hwy 120, Daniel 372 (MICH); Veracruz: 3-4 km NE of summit of Puebla-Orizaba road, Cruden 1123 (GH,MICH); Oaxaca: 3 mi S of Yanhuatlán, Woodruff 456 (TEX,MEXU); Jalisco: above Zapotitan de Hidalgo, ca. 25 mi due S of Guadalajara, Gregory & Eiten 246 (MICH). I have mapped these variants southward as var. *xylorrhiza*, but south of San Luis Potosí, they are best regarded as populational variants of var. *tenuiflora*. Their distribution, however, suggests that they once may have been more discontinuously differentiated from the red bracted plants.

Holmgren (1976, p. 199) observed that the "race" of *Castilleja tenuiflora* in the Sierra Madre Oriental has "predominantly yellow to orange coloration and more open, often secund inflorescences, most with longer pedicels." His annotations, however, show that the perception of such putative complexity resulted primarily from the inclusion of two species in his concept of this "race": (1) the yellow bracted plants identified here as *C. tenuiflora* var. *xylorrhiza*, and (2) red bracted plants with long pedicellate flowers in open inflorescences, identified here as *C. integrifolia* L. f. In northeast México, the two species occur over a similar range of elevations, but *Castilleja tenuiflora* tends to grow in rockier, more xeric habitats. While there is some degree of intergradation between these two species in their areas of sympatry, they are clearly distinct and separated by the following contrasts:

1. Leaves basally amplicate, subclasping, all evenly hirsutulous to strigose hirsute both surfaces; stem hairs spreading, usually slightly deflexed, sometimes ascending; inflorescence densely compact, without apical bracts; calyx apically red or yellow, 16-27 mm long, the abaxial cleft 12-18 mm deep; flowers sessile or on pedicels 1-6 mm long; corollas 27-31 mm long, the galea 18-21 mm long and without a prominent beard. *C. tenuiflora*
1. Leaves basally attenuate, not at all subclasping, at least the upper leaves and bracts with upper surfaces glabrous to glabrate; stem hairs retrorsely appressed; inflorescence open, the internodes 10-25 mm long, with a cluster of red bracts at the very apex; calyx apically red or greenish, 21-38 mm long, the abaxial cleft 16-31 mm deep; flowers on pedicels 10-20 mm long; corollas 30-40 mm long, the galea 21-28 mm long and densely bearded, at least at the apex. *C. integrifolia*

II. *Castilleja integrifolia* L. f. and its closest relatives in México

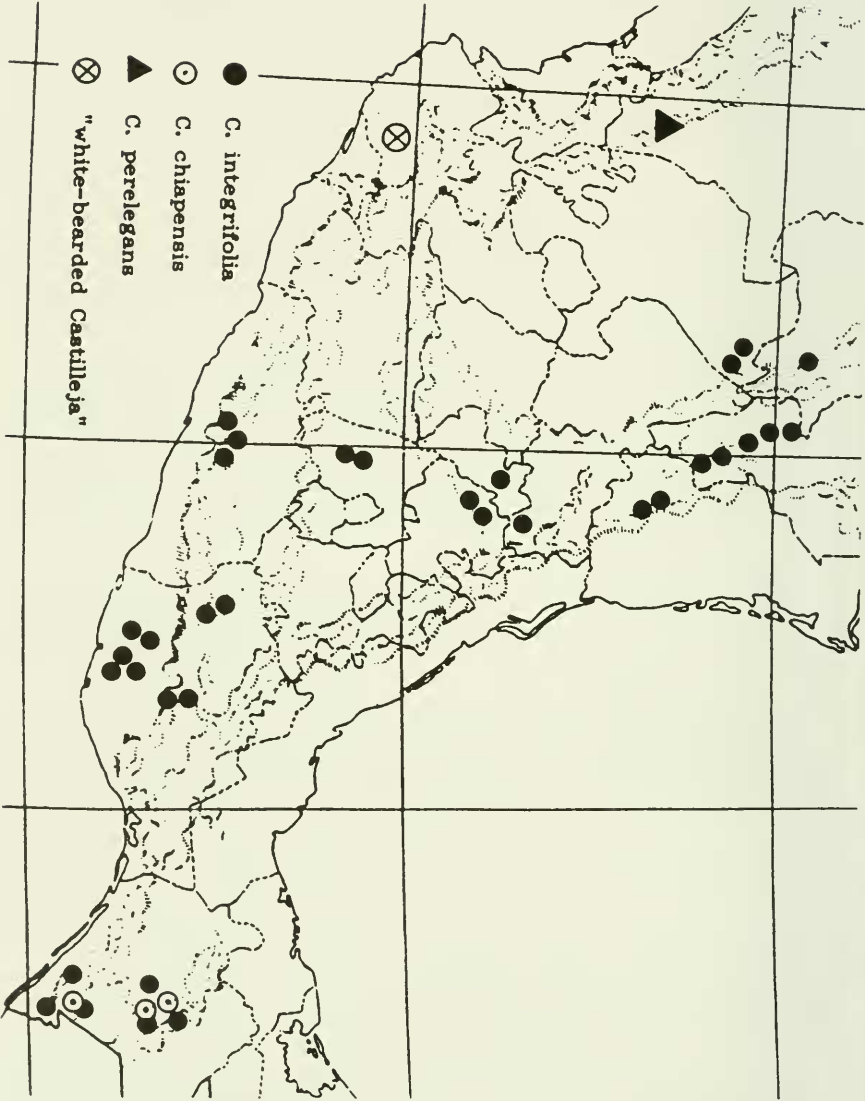
Castilleja integrifolia L. f., *Supplem. Pl.* 293. 1781. TYPE: COLOMBIA. Locality not specified, 1877, *Mutis s.n.* (LINN fiche!). The specimen clearly shows lanceolate leaves with an attenuate, nonclasping base, unevenly divided calyces, and long pedicels, but the nature of the vestiture is not clear from the fiche.

Castilleja longibracteata Mart. & Gal., *Bull. Acad. Roy. Sci. Bruxelles* 12(2):28. 1845. SYNTYPES: MEXICO. Oaxaca: dans le bois de Juquila del Sur (cote pacifique), 5000 ft, *Galeotti s.n.*; Oaxaca: a Talea et dans le Rincón (cordill. Orientale), 3000-4000 ft, Sep, *Galeotti s.n.* This taxon was noted by Eastwood (in her key and discussion) to differ from *C. integrifolia* by its larger, longer peduncular bracts, the upper ovate and apically fimbriate, these comments essentially adopted from the original description of Martens & Galeotti. I have found no pattern of variability within *C. integrifolia*-like plants, with the caveats below regarding *C. chiapensis* Brandg. and the new species from Jalisco, that would support recognition of more than one species.

Coahuila, Nuevo León, Tamaulipas, Querétaro, Hidalgo, Edo. México, Guerrero, Oaxaca, Chiapas, to Guatemala, Honduras, and El Salvador (Map 2); oak-pine, pine, and pine-fir woods, 1500-3300(-3650) m; July-November (-December, January).

As noted by Holmgren (1978), typical *Castilleja integrifolia* may prove to be restricted to South America, but the species that occurs from Central America into northeastern México has been identified as such by Williams (1973). The species in México and Central America can be consistently recognized, and even though variation is accepted within it, there is no more than occurs in other relatively widespread species of the genus. I have not evaluated the status of *C. integrifolia* var. *alpigena* L. Wms. from Guatemala, but it appears to be either a distinct species or else conspecific with the Mexican species *C. pectinata* Mart. & Gal. Otherwise, the most distinctive variants of *C. integrifolia* are among the plants from Nuevo León, Coahuila, and northern Zacatecas, which tend to produce broader and shorter leaves than elsewhere in the range, perhaps in response to the genetic influence of sympatric *C. tenuiflora*. Along the Atlantic slope of the sierra in Nuevo León, however, and in Tamaulipas, the plants are similar to those further south, and there is little justification for assigning the northern populations more than informal recognition.

Castilleja integrifolia apparently is absent from the Sierra Madre Occidental, but variant forms of *C. tenuiflora* approach it in some respects. The distinction of a previously undescribed species from the Sierra Manantlán of



Map 2. Distribution of *Castilleja integrifolia*, *C. chiapensis*, *C. perelegans*, and the "white-bearded *Castilleja*." The distribution of *C. integrifolia* continues into Central America (see text).

Jalisco (Map 2), closely related to *C. integrifolia*, is discussed in detail by Iltis & Nesom (in prep.).

Castilleja chiapensis Brandege, Univ. California Publ. Bot. 6:62. 1914.

TYPE: MEXICO. Chiapas: high region of Cerro del Boquerón, Aug 1913, C.A. Purpus 6884 (HOLOTYPE: UC; Isotype: GH!).

Central to southeastern Chiapas (Map 2); oak to oak-mixed deciduous woods, 1750-2500 m; June-September(-January).

Plants of *Castilleja chiapensis* are closely similar to *C. integrifolia* in habit and general morphology, but the stems, bracts, and calyces are densely villous with loose, spreading, yellow tinged hairs, often dense enough to completely obscure the surface (vs. glabrate to sparsely hispidulous), and the terminal bracts of the inflorescence are apically lobed or toothed (vs. entire). Further, *C. chiapensis* appears to be sympatric with typical *C. integrifolia*, and at least until field work may provide more detailed information, the two taxa can be maintained as separate species.

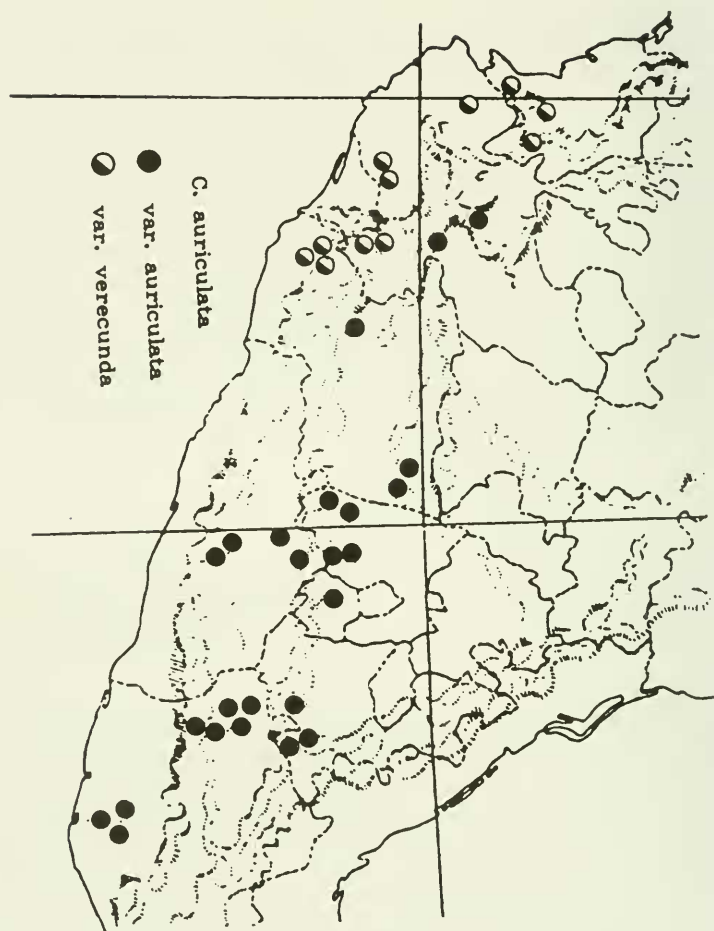
III. Variation in *Castilleja auriculata* Eastw.

Castilleja auriculata Eastw., Proc. Amer. Acad. Arts 44:583. 1909. TYPE: MEXICO. Oaxaca: between Huajuapán and Retlatzingo, Puebla, 19 Nov 1894, E.W. Nelson 1992 (HOLOTYPE: GH!; Isotype: US).

Castilleja auriculata has not been generally recognized since Eastwood's treatment, but it is a good species distinguished from *C. tenuiflora* particularly by its densely glandular leaf vestiture and pilose-villous stems. Var. *auriculata* is set apart from all of the rest of the *C. tenuiflora* group by its strongly auriculate-clasping leaves. *Castilleja auriculata* and *C. tenuiflora* are allopatric over a major part of their distributions, but they overlap along the northern periphery of the range of *C. auriculata* (Maps 1 and 3) without the production of unequivocal hybrids (see notes below regarding *C. tancitaroana*).

Eastwood (1909) recognized two species with a spicate inflorescence, deeply and irregularly cleft calyces, long flowers, and glandular vestiture: *Castilleja auriculata* and *C. longiflora* Kunze. Her key couplet separates *C. longiflora* by its ovate-lanceolate, nonimbricate leaves (vs. deltoid, densely imbricate leaves), and she offered the following comment (p. 583) regarding *C. auriculata*: "This species is nearest to *C. longiflora*, differing most noticeably in its broader, conspicuously auriculate, closely imbricate leaves. The flowers are more erect and the corollas in anthesis more in a line with the calyx."

I have not been able to find two separate taxa to match the division formalized by Eastwood among stipitate glandular plants that could be identified



Map 3. Distribution of *Castilleja auriculata* (var. *auriculata* and var. *verecunda*).

as *Castilleja auriculata* or a close relative, and (as noted above in the paragraph of taxonomic notes following *C. longiflora*), there is equal or better reason to associate *C. longiflora* with *C. tenuiflora* than with *C. auriculata*. Plants of *C. auriculata* in northern Oaxaca and immediately adjacent Puebla (the Tehuacán region, including the type locality; Map 3) produce relatively broad, mostly ascending leaves, while those in peripheral regions tend to produce narrower, spreading to descending leaves with less dense glandularity. Further, the distinctive matorral habitat of the typical plants contrasts with the more mesic habitats of those from other areas. The typical plants (*sensu stricto*) may be better treated as a separate taxon, but the difference between the two poles of variation is subtle and intergradation between them appears to be gradual. In contrast, the southwesternmost segment of *C. auriculata* can be consistently distinguished and is formally recognized.

Castilleja auriculata var. *auriculata*

Puebla, Oaxaca, Guerrero, Morelos, Edo. México, Michoacán, and Jalisco (Map 3); matorral, tropical deciduous woodlands to oak and pine-oak woodlands, often in rocky habitats, 1300-2400 m; July-January, mostly March-June in Oaxaca and Puebla.

In the area around Guadalajara, Jalisco, at the western margin of the range of var. *auriculata*, the plants approach *C. tenuiflora* in vestiture, with fewer and smaller glands and shorter and stiffer nonglandular hairs. At least some of these apparent intergrades are populational variants; one duplicate of Pringle 8763 (from the "barranca of Guadalajara") is more like *C. auriculata* (GH) while another (WIS) is more like *C. tenuiflora*.

Castilleja auriculata var. *verecunda* Nesom, var. nov. TYPE: MEXICO. Jalisco: trail from San Sebastián to Arroyo Seco, near stream in canyon bottom, 1500 m, 8 Jan 1927, Ynes Mexia 1432 (HOLOTYPE: GH!; Isotype: MICH!).

Castillejae auriculatae Eastw. typicae similis sed foliis ad bases leniter auriculatis, calycibus ac corollis brevioribus, et galea corollae hesitatione elongata differt.

Michoacán, Jalisco, Nayarit (Map 3); rocky habitats, rarely in matorral, usually in oak to oak-pine woods; 1100-2400 m; September-February.

Additional collections examined: MEXICO. Jalisco: Mpio. Cd. Guzmán, Carr. Cd. Guzmán-El Grullo, KM 21 y tomando la brecha a Media Luna, 4 km mas, 1820 m, 10 May 1988, Fuentes O. 25 (MICH); upper E slope of Sierra de Manantlán Central, on lumber road S of San Miguel "meadows," 5-6 km due S of Rincón de Manantlán, 18-19 km S of El Chante, 2200-2400 m, 12

Jan 1980, *Iltis et al. 2619* (WIS); Mpio. Tuxpan, 32 km from Cd. Guzmán on hwy to Colima, 1980 m, 20 May 1988, *Morones G. 71* (MICH); 7-9 km W of los Sauces, road to Terreros, El Terrero, Toliman, 1850-1900 m, 30 Jan 1987, *Vazquez & Guzmán 4145* (WIS-2 sheets). Michoacán: 20.6 km W of Coalcomán, 1550 m, 17 Dec 1984, *Cowan 4906* (TEX); Dist. Aquila, 20 Jan 1942, *Hinton 16302* (LL,TEX); Dist. Coalcomán, Salitre, 1200 m, 27 Oct 1938, *Hinton 12463* (GH,MICH-2 sheets); Mpio. Coalcomán, Puerto de las Cruces, 1300 m, 24 May 1963, *Rzedowski 16667* (MICH). Nayarit: hills back of Jalisco, 11 Nov 1925, *Ferris 5495* (GH); Mpio. Jala, Volcán El Ceboruca, 12 km NE of Jalpan, 1700 m, 12 Apr 1990, *Flores F. 1874* (MICH); Mpio. Tepic, 7 km S of entrance to Cuarenteno road, 1500 m, 13 Mar 1991, *Flores F. 2517* (MICH); La Atarjea, N of Yxtlan, 1100 m, 1 Oct 1926, *Mezias 884* (GH,MICH); Cerro de San Juan, SW of Tepic, 1100-1200 m, 18-19 Aug 1935, *Pennell 19776* (GH).

Var. *verecunda* is named for the reticent behavior of the corolla, which sometimes apparently may remain within the calyx at first, with only the receptive stigma exerted. The galea itself then lengthens to become fully exerted and expose the stamens. The holotype shows this clearly, as almost all of the corollas are included within the calyces, except for the protruding stigmas. Such a tendency, however, is not as pronounced as I first thought.

Plants of var. *verecunda* are morphologically and geographically distinct from typical *Castilleja auriculata*. I have identified a number of collections as var. *verecunda* from the Coalcomán area of western Michoacán, but there appears to be some intergradation with var. *auriculata* in that area (e.g., *Hinton 16302*). Although further studies may show these two taxa to be even more distinct, the most constant morphological difference between them is the nature of the leaf insertion (see key below). The difference in calyx length is quantitative and somewhat overlapping, and I have regarded the two taxa as conspecific. Their differences are summarized in the following couplet.

1. Leaf bases slightly but distinctly auriculate, appearing clasping but immediately reduced below the auricles to a narrow insertion, without any decurrent portions; calyx 12-25 mm long, the abaxial cleft 11-16 mm deep; corollas mostly 30-34 mm long at full elongation; stigma and style exerted while corolla still included within the calyx. ... var. *verecunda*
1. Leaf bases strongly auriculate-clasping, with the margins usually distinctly short decurrent or at least broadly inserted on opposite sides of the stem; calyx (20-)24-36 mm long, the abaxial cleft 13-25 mm deep; corollas 28-40 mm long; stigma and style exerted only at full elongation of the corolla. var. *auriculata*

Var. *verecunda* is superficially similar in its short calyces with more or less included corollas to another Pacific slope species of sect. *Castilleja*, *C. rhizomata* N. Holmgren. The latter, however, is stoloniferous and produces

stems only 1-3 dm tall; its stems are ridged from decurrent leaves and glandular and also very sparsely pilose with nonglandular hairs. *Castilleja auriculata* is more closely related to *C. tenuiflora* than to *C. rhizomata*.

Conspicuous glandularity of the stems and leaves has been weighted in the association of var. *verecunda* with *Castilleja auriculata*, but it also could be reasonably regarded as a variety of *C. tenuiflora*. Where the ranges of var. *verecunda* and var. *tenuiflora* are close, these two taxa appear to be more or less contiguous, not at all sympatric. Such a treatment would further emphasize the distinction of typical *C. auriculata*. Another species, at least superficially similar to *Castilleja auriculata* in its glandular leaves but perhaps more closely related to *C. tenuiflora*, is described below.

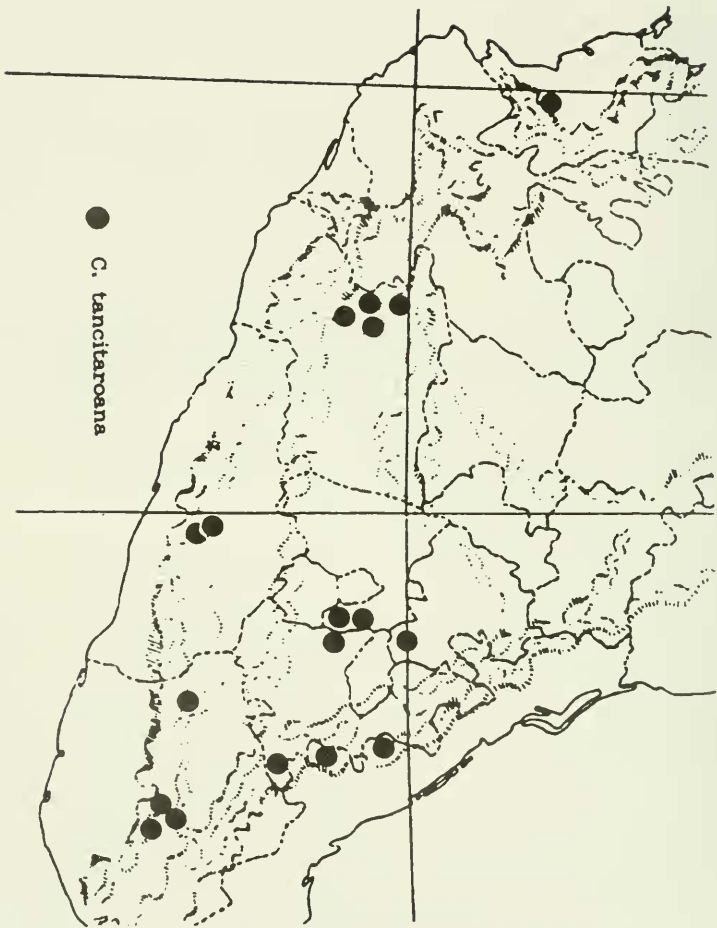
***Castilleja tancitaroana* Nesom, sp. nov.** TYPE: MEXICO. Michoacán: Mpio. Ziracuaretiro, 12 km NE of Uruapan, in San Andres Coru, pine-oak woods, "someros" soils in malpais, 1710 m, 24 May 1980, J.C. Soto N. 2211 (HOLOTYPE: TEX!; Isotype: MEXU).

Castillejae tenuiflorae Benth. similis sed foliis sparsim brevistrigosis paginis inferis glandulosis (vs. eglandulosis) et corollarum galea tubum aequanti (vs. superanti) differt.

Perennial subshrubs, the stems woody at base, 0.8-1.5 m tall, with numerous branches, the stems and calyces hispidulous with stiff, sharp pointed, spreading-deflexed hairs 0.1-0.2 mm long, eglandular or with a few short stipitate glands. Leaves linear oblong to narrowly oblong lanceolate, 3 veined, entire, spreading-deflexed, basally ampliate and subclasping, 12-30(-45) mm long, 2-6 mm wide, upper surfaces with closely appressed nonglandular hairs ca. 0.1 mm long, lower surfaces minutely and sparsely strigose to sparsely hispidulous or without eglandular hairs, with glands barely stipitate or apparently sunken and the whole surface becoming viscid. Floral bracts lanceolate, green or the upper with a red apex, not differentiated from the upper leaves in size or shape, somewhat shorter than the calyx. Flowers sessile, in crowded terminal clusters. Calyx mostly red, stipitate glandular near the apex, 22-26 mm long, the abaxial cleft 14-17 mm long, adaxial cleft 4-8 mm long, the lateral clefts linear-lanceolate notches 1-2 mm long. Corollas yellow, 25-39 mm long, the galea 13-20 mm long, equal or slightly greater than the tube length, the dorsal surface sparsely viscid-villous or merely short stipitate glandular. Capsules ovoid, 6-9 mm long.

Nayarit, Jalisco(?), Michoacán, Guerrero, Edo. México, Dist. Federal, Hidalgo, Veracruz, Puebla, Oaxaca (Map 4); thorn-scrub to oak, pine, and fir forests, (1050-)1950-3500 m; July-March.

Additional collections examined: MEXICO. Dist. Federal: 35 mi ESE of México, 10000 ft, 24 Dec 1964, *Duncan 22410* (MICH). Hidalgo: Mpio. Apan,



Map 4. Distribution of *Castilleja tancitaroana*.

S slopes of Cerro Jihuingo, 17 km NW of Apan, 2750-3250 m, 26 Jul 1966, *West T-24* (MICH,WIS). Guerrero: 60 km W of Chichihualco on rd to Puerto del Gallo, 2180 m, 24 Nov 1983, *Barrie 715* (TEX); Dist. Mina, Cerro de los Amoles, rocky open pass, ca. 2020 m, 5 Jan 1938, *Mezia 9074* (LL); 5 mi S of Tixtla, ca. 3500 ft, 14 Jul 1952, *Rowell 3070* (MICH); Mpio. Chilpancingo, 4.7 mi E of turnoff to Omeapa on hwy 93 (Tixtla-Chilapa), 26 Oct 1984, *Saunders 1444* (LL). México (Edo.): Llano Grande, faldas del Telapon, 26 Jul 1964, *Martínez 133* (MICH); 6 km SW of Río Frio on old hwy 190, 3000 m, 27 Aug 1965, *Roe et al. 1444* (MICH); Mpio. Amecameca, 2 km NE of Santa Isabel Chalma, 2600 m, 5 Oct 1969, *Pineda R. 986* (MICH); 3 km SW of Zoyatzingo, near Amecameca, 2600 m, 9 Sep 1968, *Pineda R. 524* (MICH); N slope of Mt. Popocatepetl, 10400 ft, 24 Jul 1957, *Straw & Gregory 1023* (MICH). Michoacán: Mpio. Tancitaro, 2 mi above Tancitaro, 7000 ft and in pastures up to 11500 ft, 10 Aug 1940, *Leavenworth 533* (GH); Mpio. Tancitaro, open grassy slope of Mt. Tancitaro, 11000 ft, 19 Aug 1940, *Leavenworth 665* (GH,MICH); Mpio. Tancitaro, Mt. Tancitaro, open ridges above cloud forest, 9500 ft, 25 Jul 1941, *Leavenworth & Hoogstral 1210* (GH,MICH); Mpio. Tangancicuaro, N slope of Mt. Patamban, 9500-11000 ft, 1-4 Feb 1903, *Nelson 6587* (GH); Mpio. Uruapan, SE edge of Nuevo San Juan Parangaricutiro, ca. 13 km W of Uruapan, on malpais, 1950 m, 13 Jan 1992, *Prather 1238* (TEX); N of Uruapan on road to Paricutin, 27 Jan 1963, *Templeton 9418* (MICH); Mpio. Tangancicuaro, NW slopes of Cerro Patamban, 2800-3000 m, 20 Nov 1971, *Rzedowski & McVaugh 662* (MICH). Nayarit: Rancho San Isidro, valley of the Río Jesús María, ca. 10 km E of the village of Jesús María, W slope of the Sierra de Huichol, 1000 m, 20-21 Sep 1969, *Feddema 1440* (MICH). Oaxaca: Sierra Juárez, Cerro de Humo, 2 Mar 1945, *Alexander 831* (MICH); between Tuxtepec and Cd. Oaxaca on Hwy 175, 66 km SW of Tuxtepec, 11 Jan 1982, *Elliot 381* (WIS); Mpio. Constanza del Rosario, 3 mi S of jct to Santiago Juchtlahuaca on Rte 125 to Putla, 1320 m, 31 May 1986, *Luckow 3247* (TEX); 30 km ENE of Ayutla on road between Mitla and Zacatepec, at jct with rd to Totontepec, 2500 m, 22 Jun 1986, *Diggs et al. 3936* (TEX). Puebla: Popocatepetl, 3000 m, 11 Apr 1947, *Miranda & Barkley 17M203* (TEX); Mpio. Coxcatlán, 22 km from Coxcatlán, W of Tepeloyo, 15 Apr 1985, *Tenorio 8807* (TEX). Veracruz: 0.8 mi S on Hwy 150 (cuota) from jct with Veracruz state line, 7700 ft, 9 Jul 1990, *Jones 5312* (MICH); Mpio. Perote, La Muñeca, 2400 m, 27 Oct 1973, *Ventura A. 9194* (MICH); Maltrata, Jan 1883, *Kerber 261* (MICH).

The epithet of *Castilleja tancitaroana* reflects my first recognition of these plants as the common species in west central Michoacán, particularly in the Mount Tancitaro area. Only after annotating a number of specimens with this geographical epithet did I realize that the distribution of this species was significantly wider. The stems of *C. tancitaroana* are eglandular and usually produce strongly deflexed to spreading deflexed hairs, but these plants are rec-

ognized primarily by their glandular lower leaf surfaces and generally reduced foliar vestiture: the upper surfaces vary from glabrate to sparsely strigose with small, usually appressed, nonglandular hairs, and the lower surfaces are distinctly glandular with sunken, sessile, or short stipitate glands. When the glands are sunken, the entire lower surface becomes viscid-resinous.

Castilleja tancitaroana is completely sympatric with *C. tenuiflora* (although not nearly so widely distributed as the latter) and intermediates between the two can be found. For the most part, however, they appear to be very distinct. I have considered the possibility that *C. tancitaroana* represents only glandular variants within populations of *C. tenuiflora*. In western Michoacán, however, *C. tenuiflora* apparently is rare or absent but *C. tancitaroana* is common, and the range of *C. tenuiflora* (eglandular) extends far northward beyond that of *C. tancitaroana*. Further, the cauline vestiture of *C. tancitaroana* is more like that of *C. integrifolia* than of *C. tenuiflora*.

There is also the possibility that *Castilleja tancitaroana*, with its distinctive foliar glandularity, originated as a hybrid between *C. tenuiflora* and *C. auriculata*. If this were true, however, such a putative hybrid appears to be reproducing apart from its parents, because the ranges of *C. tancitaroana* and *C. auriculata* are different, particularly in Hidalgo, western Edo. México, and Veracruz (*C. auriculata* absent) and in southwestern Jalisco and Michoacán (*C. tancitaroana* absent). Further, the distinctive leaf insertion of *C. auriculata* (var. *auriculata*) does not appear in *C. tancitaroana*.

In summary, *Castilleja tancitaroana* and the varieties of *C. tenuiflora* and *C. auriculata* form a closely related group of plants ("the *tenuiflora* group"). Of these, var. *auriculata* may prove to stand apart somewhat from the others. Their differences are summarized below in the key to the taxa of sect. *Castilleja*. Clearly, the relationships among these intimately related taxa need to be studied in more detail, and field studies in areas of sympatry will be critical in refining the hypotheses presented here regarding the delimitation of taxa.

IV. Three new species peripherally related to *C. tenuiflora*

***Castilleja stipifolia* Nesom, sp. nov.** TYPE: MEXICO. Jalisco: Cerro de Tequila, a rugged volcanic cone 13 km due S of Tequila, oak forest with scattered *Alnus* and *Arbutus*, small basaltic cliffs and in woods, 2700-2900 m, 29 Dec 1978, H. Illis et al. 1016 (HOLOTYPE: WIS!).

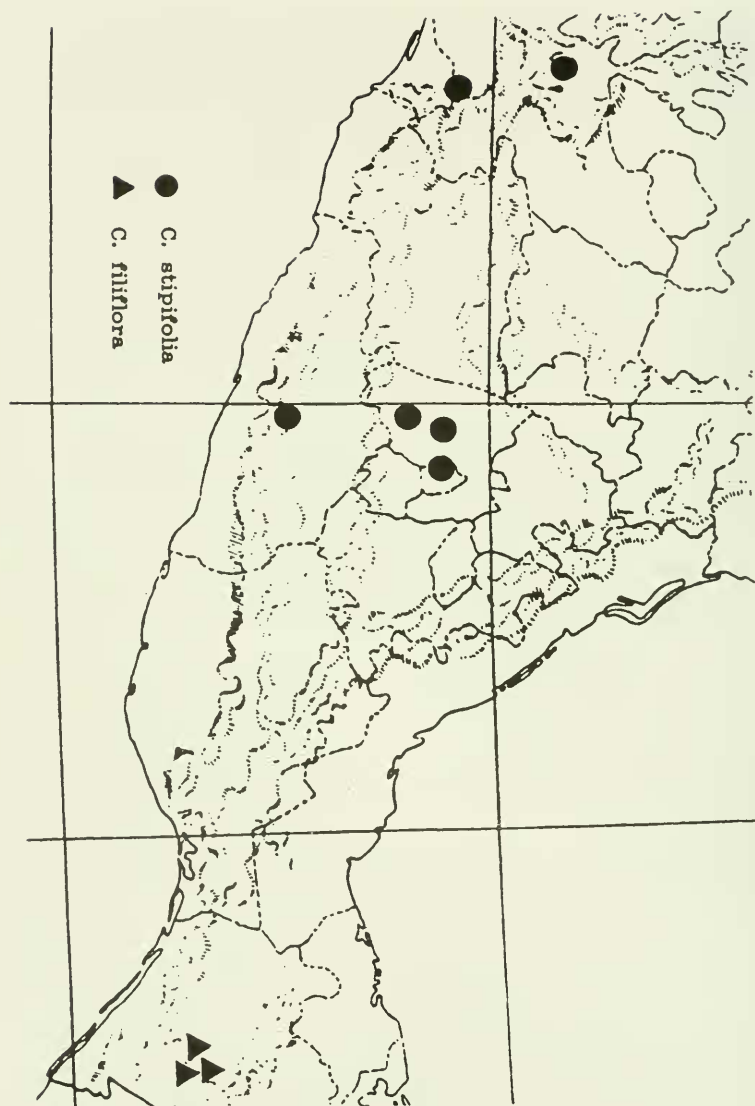
Castillejae tenuiflorae Benth. similis sed cristis demissis secus caules basibus decurrentibus foliorum exorientibus, bracteis floralibus ac caulibus in inflorescentia glandulosis, et foliis non amplexantibus parum sed distincte stipitatis differt.

Perennial herbs with many slender, ascending, woody based stems 16-30 cm tall arising from a woody taproot, the stems with low but prominent longitudinal ridges formed from decurrent leaf bases. Stems stipitate glandular in and near the inflorescence, eglandular below that and sparsely hispid with spreading to slightly deflexed hairs. Leaves spreading to slightly deflexed, moderately hispid-strigose with spreading-ascending cilia, eglandular, linear-oblong to linear-lanceolate, 10-18(-20) mm long, 1.5-2.0(-4.0) mm wide, entire or with a pair of narrow lobes, abruptly attenuate to a nonclasping base and borne on a short stipe, decurrent for the length of the internode. Floral bracts green, stipitate glandular and sparsely pilose-hirsute, entire or commonly with a pair of narrow, spreading lobes on the distal half, terminal bracts absent. Flowers 4-8 per stem, sessile or on pedicels 1-4 mm long. Calyx red to orange on the upper 2/3, (22-)24-29 mm long, abaxial cleft 14-16 mm deep, adaxial cleft 3-5 mm deep, lateral clefts notches ca. 1 mm deep. Corollas 26-38 mm long, the lower lip of 3 green, thickened teeth 1 mm long, the galea 13-22 mm long, equal or slightly longer than the tube, sparsely pilose at the apex with stipitate glandular and nonglandular hairs, long exserted from the calyx. Mature fruits not seen.

Dist. Federal, western Edo. México, Guerrero, [Michoacán?], Jalisco (Map 5); pine-fir-oak to fir woods, less commonly in mesic oak woods, 2700-3200 m; December-September or probably all year.

Additional collections examined. MEXICO: Distrito Federal: Llanos de Copilco, Cañada de Contreras, cerca del 4^o Dinamo, ladera andesítica con roca volcánica, 3000 m, 5 May 1968, *J. Tirado Lizarraga s.n.* (WIS). Edo. México: Road between Toluca and Temascaltepec, ca. 45 km NE of Temascaltepec; steep N-facing slopes, 3025 m, 22 Jun 1979, *Diggs 2294* (WIS); Dist. Temascaltepec, Meson Viejo, 2830 m, 4 Apr 1933, *Hinton 3686* (MICH); N slopes of Volcán de Toluca, along road to crater, ca. 3200 m, 22 Jan 1963, *Iltis 1697* (WIS); 32 km from Toluca on road to Temascaltepec, 28 Jul 1962, *Molseed 62* (MICH). Guerrero: Near Omiltemi, 20 mi W of Chilpancingo, 7500-8000 ft, 31 Jul 1957, *Straw & Gregory 1059* (MICH). Jalisco: Cerro de Tequila, a rugged volcanic cone 13 km due S of Tequila, small basaltic cliffs and in woods, 2700-2900 m, 29 Dec 1978, *Iltis et al. 1009* (WIS); NE slopes of the Nevado de Colima, below Canoa de Leoncito, steep mountainsides, 2900-3100 m, 10 Sep 1952, *McVaugh 12872* (MICH).

Plants of *Castilleja stipifolia* have been identified mostly as *C. tenuiflora* but are immediately distinct from the latter in their nonclasping leaves decurrent as low ridges along the stems and basally attenuate to a stipitate insertion, their leaves and bracts that are sometimes lobed, and glandular upper stems. The production of leaves and bracts with conspicuous lobes and flowers with longer pedicels is variable, and further collections will be important in interpreting the extent of variability. At least superficially, *C. stipifolia* appears to be more similar in leaf morphology (decurrent, stipitate, not auriculate-



Map 5. Distribution of *Castilleja stipifolia* and *C. filiflora*.

clasping) to *C. rhizomata* N. Holmgren and *C. linifolia* N. Holmgren, endemics of Durango and Chihuahua, respectively.

Typical *Castilleja tenuiflora* is sympatric with *C. stipifolia*, although the latter apparently is much less common. I have found no records of the new species from Michoacán, but it almost certainly occurs there in habitats within pine or pine-fir woods.

***Castilleja filiflora* Nesom, sp. nov.** TYPE: MEXICO. Chiapas: Mpio. Zinacantan, Barrio San Nicolas, 2910-3110 m, 24 Sep 1986, *A. Mendez Ton 9277* (HOLOTYPE: TEX!; Isotypes: CAS, MEXU).

Castillejae tapeinocladae Loesn. similis sed caulibus erectis et foliis ac bracteis floralibus lineari-lanceolatis vel filiformibus interisque differt.

Annual or short lived perennial herbs, from slender woody roots, producing erect stems 12-35 cm tall, 3-6 or more stems arising from the base, the herbage eglandular, glabrate to sparsely invested with deflexed to antrorsely appressed hairs 0.1-0.4 mm long. Leaves entire, 3 veined, linear-lanceolate, 20-45 mm long, 0.6-2.0 mm wide, ascending, sessile, not at all basally clasping. Inflorescence on upper 1/2-1/3 of the stems; floral bracts linear to filiform, not differentiated from the upper leaves, equal to or slightly shorter than the associated calyx, green or the uppermost with red tips. Flowers separated on internodes 15-30 mm long, borne on pedicels 1-5(-12) mm long. Calyces red from base to tip, 22-28(-34) mm long, the abaxial cleft 18-22(-26) mm deep, the adaxial cleft 2-3 mm deep, lateral clefts minute notches or absent. Corollas 27-34 mm long, the lower lip of 3 thick teeth ca. 1 mm long, the galea 17-24 mm long, 60-70% of the corolla length, narrowly tubular, yellow with red flanges, densely bearded, long exserted from the calyx. Capsules ovoid, 9-15 mm long.

Additional collections examined: MEXICO. Chiapas: Mpio. San Cristóbal Las Casas, extensive marsh at S end of the valley of San Cristóbal, 2200 m, 22 May 1972, *Breedlove 25280* (LL, TEX); Mpio. Zinacantan, ridge between Paraje of Nachih and Zinacantan Center, 2350 m, 16 Aug 1976, *Breedlove 39646* (MICH); near San Cristóbal, Cerro de Guadalupe, Jun-Aug 1864-70, *Ghiesbreght 654* (GH).

All collections cited here of *Castilleja filiflora* were made in the vicinity of San Cristóbal, Chiapas (Map 5). Within sect. *Castilleja*, the species is distinguished by its small stature, thin roots, sparse vestiture, linear-lanceolate, entire, nonclasping leaves, filiform floral bracts, widely spaced flowers on relatively short pedicels, and completely red calyces with an extremely deep abaxial cleft. The epithet calls attention to the long, narrowly tubular galea.

The more recent collections of *Castilleja filiflora* were distributed as *C. tapeinoclada* Loesn., and the two are similar in their thin roots, eglandular vestiture of small, deflexed hairs, open and extended inflorescence, and corollas with a bearded, very narrow galea. While it is likely that these two species are closely related, *C. tapeinoclada* is endemic to the Guatemala highlands and comprises plants that produce prostrate stems, lobed floral bracts (the leaves also often lobed) with relatively broad midportions, and narrowly oblong-lanceolate leaves.

Castilleja perelegans Nesom, *sp. nov.* TYPE: MEXICO. Durango: Metates, N of Cueva, bushy, pine-covered crest of Sierra Madre, 2800-2900 m, 29-30 Aug 1934, *F.W. Pennell 18394* (HOLOTYPE: GH!; Isotype: MICH!).

Species novum ex affinitate *Castillejæ tenuifloræ* Benth. et specierum affinium distinguenda vestimento caulorum trichomatibus patentibus crassis praecipue longis, foliis lanci-ovatis, eglandulosisque minute hispidulis, floribus longis sessilibusque, bracteis amplis obovatisque subtentis, bracteae florales ac calyces penitus rubentes, et fissuris calycis adaxialibus ac lateralibus equaliter vadosis, apicibus lobarum rotundatis.

Perennial subshrubs, stems 25-50 cm tall, erect, the lower portions slightly woody, simple or with a few branches on the lower half, sparsely and loosely villous with vitreous, flattened, eglandular hairs mostly 1-2 mm long, mixed with shorter, stipitate glandular hairs, the latter more common in the inflorescence. Leaves spreading, densely crowded on the lower stems, on internodes 1-2 cm long at midstem, lance-ovate, (3-)5 veined, mostly 3-5 cm long, 6-15 mm wide, basally subclasping but not at all auriculate, eglandular or nearly so, the lower surface hispidulous, especially along the veins and margins, the upper surface glabrate. Floral bracts spreading-ascending, the whole bract red-orange, the lowermost lance-ovate like the leaves, with an immediate transition to obovate or oblong-obovate, mostly 2.5-3.0 cm long, 7-12 mm wide. Flowers sessile, the lower separated by internodes 1.0-1.5 cm long, the upper more congested. Calyx completely red, finely villous glandular below, puberulent near the apex, slightly but distinctly curved, not at all medially constricted, 30-35 mm long, the abaxial cleft 18-20 mm deep, the adaxial and lateral clefts nearly equal in size, 2-3 mm deep, the lobes with rounded apices. Corolla yellow-green with red flanges, 36-41 mm long, the galea equal the tube length, sparsely bearded, exerted 5-9 mm from the calyx. Stigma barely expanded. Fruits broadly ovate, 8-9 mm long, 5-6 mm wide. Known only from the type collection (Map 2).

Castilleja perelegans is characterized by the following features: (1) stem vestiture of particularly long and thick, spreading hairs, (2) lance-ovate, minutely

hispidulous, eglandular leaves, (3) long, sessile flowers subtended by large, obovate bracts, the bracts and calyces completely reddish, and (4) calyces with the adaxial and lateral clefts equally shallow, the lobes with rounded apices. It is a strikingly beautiful and distinctive plant, as also recognized by Pennell, its only known collector, who identified it as the "type collection" of a name that was never published. Although it is clear that the new species is a member of sect. *Castilleja*, the nature of its relationship to the rest of the section is not apparent.

V. A new combination in Californian *Castilleja*

Chuang & Heckard (1992) have recently proposed a set of nomenclatural changes for *Castilleja* of California. One of these involves a taxon of sect. *Castilleja* that occurs in México. I agree with their assessment of variation in *C. subinclusa* E. Greene, but in order to bring the name into alignment with my other nomenclature for Mexican species, the following combination is necessary.

Castilleja subinclusa* E. Greene var. *franciscana* (Penn.) Nesom, *comb. et stat. nov. BASIONYM: *Castilleja franciscana* Penn., Proc. Acad. Nat. Sci. Philadelphia 99:188. 1947. *Castilleja subinclusa* E. Greene subsp. *franciscana* (Penn.) Chuang & Heckard, Novon 2:188. 1992.

VI. Provisional key to the Mexican and Guatemalan taxa of sect. *Castilleja* and others with an irregularly divided calyx

The taxa included in the following key include those with an irregularly cleft calyx, the abaxial cleft deep and the adaxial one shallow. Eastwood (1909) regarded *Castilleja subalpina* Eastw. as most similar to the species of sect. *Castilleja*, but the plants of the holotype (GH!) clearly belong instead with the taxa centered around *C. scorzoneraefolia* Kunth (sect. *Euchroma* [Nutt.] Benth.). The species identified in the key below as *C. pectinata* (tentatively including *C. orizabaë* Benth.) and *C. purpusii*, as well as those of sect. *Epichroma*, are in need of comparative study.

Castilleja ctenodonta Eastw. and *C. altorum* Standl. & Steyererm., which apparently are sister species, are the most divergent taxa regarded here as members of sect. *Castilleja*. Eastwood (1909) treated *C. ctenodonta* within sect. *Euchroma*, noting that it is transitional to sect. *Castilleja*. Both species produce nearly pectinate leaves and a vestiture of long stipitate glands, which suggest that they might be related to sect. *Epichroma*, but their corollas have galea and tube of equal length, and the slender foliar lobes as well as the slender rhizomes are anomalous among their possible relatives.

1. Corollas with the galea equaling or longer than the tube length.
.....Sect. *Castilleja* (8)
1. Corollas with the galea ca. half the length of the tube.(2)
 2. Leaves pectinately divided; herbaceous annuals (4 species) from a slender taproot or perennial (1 species) from a woody root.
.....Sect. *Epichroma* Benth. (4)
 2. Leaves entire; woody based perennials from woody roots.
.....the "Ortegae group." (3)
3. Stems slightly ribbed with decurrent leaf bases; leaves narrowly elliptic to linear-lanceolate; calyx with spreading, stipitate glandular and eglandular hairs; Chihuahua, Sonora, Durango, Sinaloa. .. *C. ortegae* Standley
3. Stems strongly ribbed with decurrent leaf bases; leaves linear to filiform; calyx eglandular but with short, coarse, ascending hairs; Jalisco.
.....*C. pterocaulon* N. Holmgren
 4. Plants perennial; Durango, Sinaloa. *C. roei* Crosswh.
 4. Plants annual; Oaxaca to Jalisco.(5)
5. Calyx red to orange.(7)
5. Calyx yellow.(6)
 6. Calyx 12-17(-22) mm long; Oaxaca, Guerrero, Morelos, Edo. México, Distrito Federal. *C. aurea* Rob. & Greenm.
 6. Calyx 8-10 mm long; Guanajuato, Edo. México, Morelos, Oaxaca.
..... *C. gracilis* Benth.
7. Plants ca. 5-8 cm tall; floral bracts differentiated from the leaves, with the medial portion distinctly broadened rather than filiform; calyx 9-16 mm long; lower lip of corolla with teeth 2-3 mm long; Guerrero.
..... *C. venusta* Rzed.
7. Plants mostly 15-90 cm tall; floral bracts like the leaves, pinnatifid with medial portion and lobes filiform; calyx (13-)15-30 mm long; lower lip of corolla with teeth 0.5-1.0 mm long; Jalisco, Michoacán, Guerrero, Oaxaca. *C. tenuifolia* Mart. & Gal.
 8. Leaves and floral bracts entire.(14)
 8. Leaves and/or floral bracts lobed or divided.(9)
9. Stems and leaves glabrous or nearly so; Sonora, southwestern United States. *C. linariifolia* Benth.

9. Stems and leaves prominently hairy. (10)
 10. Plants arising from woody roots; stems and leaves eglandular or nearly so; leaves with mostly 1-3 pairs of long lobes. (12)
 10. Plants arising from slender rhizomes or rhizomelike caudex branches; stems and leaves with long, stipitate glandular hairs; leaves with 3-6 pairs of short, nearly filiform lobes arising from a broad midportion. (11)
11. Vestiture of glandular hairs only; Oaxaca. *C. ctenodonta* Eastw.
11. Vestiture of glandular and eglandular hairs; Guatemala.
 *C. altorum* Standl. & Steyerf.
12. Plants of Chihuahua, Durango, and the southwestern United States.
 *C. patriotica* Fern.
12. Plants of southern México to Guatemala. (13)
13. Leaves and stems densely invested with loose, vitreous hairs mostly 1 mm long; Edo. México and Puebla (Popocatepetl and Ixtacchuatl). ..
 *C. purpusii* Brändeg.
13. Leaves and stems sparsely invested with stiff, whitish, hairs mostly 0.2-0.4 mm long, commonly deflexed on the stems; Veracruz, Puebla, Chiapas, and Guatemala. *C. pectinata* Mart. & Gal.
14. Stems and leaves conspicuously hairy, sometimes also glandular. .
 (16)
14. Stems and leaves glabrous or nearly so. (15)
15. Primary cauline leaves linear-lanceolate, the axillary filiform; calyx (20-) 23-38 mm long, glabrous to sparsely pilose with loose, spreading hairs; galea sparsely pilose bearded; Durango. *C. linifolia* N. Holmgren
15. Cauline leaves filiform; calyx 16-23 mm long, glabrous; galea minutely stipitate glandular, without other hairs; Jalisco.
 *C. macvaughii* N. Holmgren
16. Leaves mostly linear-oblong, sessile, not auriculate or decurrent; corolla with the galea shorter than the tube; California and Baja California. *C. subinclusa* var. *franciscana* (Penn.) Nesom
16. Leaves auriculate and clasping or nonauriculate and sessile and then often slightly decurrent; corolla with the galea equal or longer than the tube; southeastern Arizona, México, Guatemala. ... (17)

17. Floral bracts obovate, 7-12 mm wide, completely reddish; stem hairs 1-2 mm long; southern Durango. *C. perelegans* Nesom
17. Floral bracts linear, linear-lanceolate, or narrowly oblong-lanceolate, 1-5 mm wide; stem hairs less than 1 mm long. (18)
 18. Inflorescence floriferous to the apex, without prominent, broad, apical bracts; pedicels absent or up to 6 mm long; galea variously invested. (21)
 18. Inflorescence with an apical cluster of red bracts not associated with flowers; pedicels mostly 10-20 mm long; galea densely pilose bearded. (19)
19. Stems and leaves with antrorsely appressed hairs; Jalisco.
 "white-bearded *Castilleja*" Iltis & Nesom, *ined.*
19. Stems with retrorsely deflexed-appressed hairs; eastern México, primarily from Chiapas to Nuevo León and Coahuila. (20)
 20. Stems, bracts, and calyces densely villous with loose, spreading, yellow-tinged hairs, often dense enough to completely obscure the surface; terminal bracts of the inflorescence apically lobed or toothed; Chiapas. *C. chiapensis* Brandeg.
 20. Stems, bracts, and calyces glabrate to sparsely hispidulous; terminal bracts of the inflorescence entire; Chiapas to Nuevo León and Coahuila (Map 2). *C. integrifolia* L. f.
21. Plants mostly 5-12 dm tall (if shorter, from Chihuahua), roots (or rhizomes) distinctly thickened and woody; leaves and floral bracts mostly narrowly oblong; flowers usually densely congested at the stem apex. .
 (23)
21. Plants prostrate or erect and 1-4 dm tall, roots very thin; leaves narrowly lanceolate, floral bracts filiform to narrowly lanceolate; flowers loosely arranged, separated by internodes 15-30 mm long. (22)
 22. Plants prostrate; leaves narrowly oblong-lanceolate, often lobed; floral bracts with lobes arising from a broad midportion; Guatemala.
 *C. tapeinoclada* Loesn.
 22. Plants erect; leaves linear-lanceolate, entire; floral bracts filiform; Chiapas. *C. filiflora* Nesom
23. Cauline leaves basally attenuate to a nonclasping base, decurrent as thin, low ribs along the stem, the upper leaves and/or floral bracts commonly lobed; stems stipitate glandular near the inflorescence, eglandular below; Edo. México, Dist. Federal, Guerrero, and Jalisco. . *C. stipifolia* Nesom

23. Cauline leaves at least slightly auriculate at the base, clasping to subclasping, not at all decurrent, all leaves and bracts entire; stems glandular or eglandular. (24)
24. Plants 1-3 dm tall, basally herbaceous, arising from rhizomes; at least the upper stems and leaves and often the whole plant stipitate glandular; southern to west central Chihuahua.
..... *C. rhizomata* N. Holmgren
24. Plants 5-12 dm tall, basally woody, arising from a woody root, without rhizomes; plants glandular or eglandular; variously distributed. (25)
25. Leaves glandular at least on the lower surfaces, commonly also pilose or strigose with non glandular hairs; galea ca. 1/2 the corolla length. (27)
25. Leaves eglandular, hispid-hirsute; galea ca. 2/3 the corolla length. . (26)
26. Calyx red at least at the apex; widespread, Sonora to Coahuila and Nuevo León, south to Jalisco, Veracruz, and Oaxaca.
..... *C. tenuiflora* Benth. var. *tenuiflora*
26. Calyx yellow at least at the apex, without red coloration; Durango, Coahuila, Nuevo León, Zacatecas, and San Luis Potosí.
..... *C. tenuiflora* var. *zylorrhiza* (Eastw.) Nesom
27. Stems sparsely to moderately invested with deflexed hairs mostly less than 0.2 mm long; cauline leaves relatively widely spaced along stems, without strongly developed axillary clusters; lower leaf surfaces with sunken, sessile, or short stipitate glands, usually with few other hairs, the upper surfaces glabrate to sparsely strigose with appressed, nonglandular hairs, sometimes also with sessile or short stipitate glands; calyx 22-26 mm long; Nayarit, Jalisco(?), Michoacán, Guerrero, Edo. México, Hidalgo, Veracruz, Puebla, and Oaxaca. *C. tancitaroana* Nesom
27. Stems densely villous-pilose, at least some of the hairs longer than 0.5 mm; primary cauline leaves and smaller axillary clusters densely arranged on stems; upper and lower leaf surfaces densely invested with stipitate glands, commonly also with nonglandular hairs; calyx 12-36 mm long. (28)
28. Leaf bases strongly auriculate clasping, with the margins usually distinctly short-decurrent or at least broadly inserted on opposite sides of the stem; calyx (20-)24-36 mm long, the abaxial cleft 13-25 mm deep; Oaxaca, Puebla, Morelos, Guerrero, Edo. México, and Michoacán. *C. auriculata* Eastw. var. *auriculata*

28. Leaf bases slightly but distinctly auriculate, appearing clasping but immediately reduced below the auricles to a narrow insertion, without any decurrent portions; calyx 12-25 mm long, the abaxial cleft 11-16 mm deep; Michoacán, Jalisco, and Nayarit.
 *C. auriculata* var. *verecunda* Nesom

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